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CONNECTOR BRACKETS

SPECIFICATION

Background of the Invention

Field of the Invention

The present invention relates to a method and apparatus for mounting within an elevator shaft counterweight rails or guide rails for elevator cars. More particularly, the invention concerns a mounting system in which the guide rails are adjustably attached to one or more intermediate beams that are disposed within the elevator shaft.

Discussion of the Prior Art

A typical prior art electric power elevator system has an elevator shaft or hoistway within which guide rails are mounted to guide the vertical travel of elevator cars and counterweights. In many instances in prior art construction, intermediate beams are used to divide an elevator shaft into two or more parts forming channels for separate cars moving along guide rails attached to intermediate beams. Guide rails for counterweights can also be mounted on the intermediate beams.

In the past, the guide rails for elevator cars or counterweights were secured to the intermediate beams using various bars and plates that were secured to the beams by welding. This prior art installation technique is both cumbersome and time consuming even in new construction. However, in retrofit constructions, the technique is particularly difficult. For example, when the elevator systems in hospitals, schools, and other public buildings are retrofitted, the welding step is quite hazardous and most undesirable. This is because, during the retrofit operations, welding of the rail brackets to the support brackets results in noxious welding gases and fumes unavoidably spreading throughout the building. Particularly in hospitals and schools, these noxious welding gases can be both unpleasant and hazardous and can, on occasion, result in serious complications to the persons exposed to the noxious fumes.

This major drawback of the prior art processes was largely overcome by the novel methods and apparatus described in U.S. Patent No. 6,196,356 issued to the present inventor. The present invention seeks to improve upon the apparatus described in the earlier patent by providing uniquely configured, readily adjustable support and guide rail brackets that can be safely and securely interconnected with beams disposed within the elevator hoistways that house the elevator systems.

As will be better understood from the description, which follows, the apparatus of the present invention includes novel beam interconnection means for interconnecting the rail support brackets with both vertically and horizontally extending beams. Additionally, in certain instances, the connector legs of the support and guide rail brackets of the apparatus are provided with a plurality of strategically arranged, indexable connector holes that permit the necessary degree of adjustment of the brackets to properly position the guide rails within the hoistway. When selected pairs of connector holes provided in the brackets are appropriately aligned, the brackets can be securely bolted together using specially configured bolts that provide substantial structural integrity and positively preclude shifting of the brackets even as a result of projected seismic loading. In other instances, novel brackets of various configuration are used to adjustably attach the guide rails to one or more walls that cooperate to define the elevator hoistway.

Summary of the Invention

It is an object of the present invention to provide a novel method and apparatus for quickly, easily, and adjustably connecting elevator car and counterweight guide rail support brackets to either vertically or horizontally

extending structural beams that are disposed within an elevator hoistway of a building.

Another object of the invention is to provide a novel method and apparatus for quickly, easily, and adjustably connecting elevator car and counterweight guide rail support brackets to the sidewalls of an elevator hoistway of a building.

Another object of the invention is to provide a method of the aforementioned character, which requires no welding operations to be performed in order to connect the brackets to the beams.

Another object of the invention is to provide connector brackets of the character described which include cooperating support and connector brackets each having a plurality of strategically arranged, indexable connector holes that permit the necessary degree of adjustment of the brackets to properly position the guide rails within the hoistway.

Another object of the invention is to provide an apparatus as described in the preceding paragraphs that includes specially configured connector bolts that provide substantial structural integrity and positively preclude shifting of the brackets even as a result of projected seismic loading.

Brief Description of the Drawings

Figures 1A and 1B when considered together comprise a top plan view of a multiple elevator and multiple counterweight system that is disposed within a conventional elevator shaft and embodies various of the adjustable support brackets of the present invention.

Figure 2 is a greatly enlarged, cross-sectional view of the left-hand portion of the counterweight system shown in the upper left-hand portion of figure 1A.

Figure 3 is a view taken along lines 3-3 of figure 2.

Figure 4 is a generally perspective, fragmentary view of a portion of the angle bracket that is interconnected with the vertical supporting beams of the counterweight system and a portion of the counterweight rail support bracket that is adjustably interconnected thereto.

Figure 5 is a greatly enlarged view of the left-hand portion of the counterweight rail support system shown in the upper right-hand portion of figure 1B.

Figure 6 is a view taken along lines 6-6 of figure 5.

Figure 7 is a generally perspective, fragmentary view of a portion of the angle brackets of the counterweight rail support shown in figure 6 and a

portion of the rail support bracket shown in figure 6 that is interconnected therewith.

Figure 8 is a greatly enlarged front view of the left-hand elevator rail support system shown in the lower left-hand portion of figure 1A.

Figure 9 is a cross-sectional view taken along lines 9-9 of figure 8.

Figure 10 is a front view of the elevator rail support system shown in the lower central portion of figure 1A.

Figure 11 is a view taken along lines 11-11 of figure 10.

Figure 12 is a cross-sectional view taken along lines 12-12 of figure 11.

Figure 13 is a generally perspective, fragmentary view of a portion of the angle bracket that supports one of the elevator rails and a portion of the angle bracket that is adjustably connected to the pair of vertically extending support beams and illustrating the manner of adjustable interconnection of the angle brackets.

Figure 14 is a front view of an alternate form of the elevator rail support system shown in the lower central portion of figure 1A.

Figure 15 is a cross-sectional view taken along lines 15-15 of figure 14.

Figure 16 is a cross-sectional view taken along lines 16-16 of figure 14.

Figure 16A is a greatly enlarged front view of the elevator car rail support system shown in the lower right hand portion of figure 1B.

Figure 16B is a view taken along lines 16B-16B of figure 16A.

Figure 17 is a plan view of an alternate form of connector apparatus of the invention for connecting elevator guide rails to a horizontally extending beam.

Figure 18 is a cross-sectional view taken along lines 18-18 of Figure 17.

Figure 19 is a view taken along lines 19-19 of figure 18.

Figure 20 is a greatly enlarged front view of an alternate form of elevator car support system in which the car rails are adjustably interconnected with an I-beam rather than with a hollow rectangular beam of the character shown in figure 17.

Figure 21 is a view taken along lines 21-21 of figure 20.

Figure 22 is a cross-sectional view taken along lines 22-22 of figure 20.

Figure 23 is a greatly enlarged front view of yet another form of elevator rail support system of the character shown in the lower central portion

shown in figure 1B in which the elevator support rails are adjustably connected to a hollow vertical support beam by means of a differently configured bracket arrangement.

Figure 24 is a cross-sectional view taken along lines 24-24 of figure 23.

Figure 25 is a cross-sectional view taken along lines 25-25 of figure 23.

Figure 26 is a front view of still another form of an elevator car rail support system of the invention.

Figure 27 is a cross-sectional view taken along lines 27-27 of figure 26.

Figure 28 is a top plan view of yet another form of an elevator support system of the invention.

Figure 29 is a cross-sectional view taken along lines 29-29 of figure 28.

Figure 30 is a front view of an alternate form of connector apparatus of the invention for connecting elevator guide rails to a horizontally extending beam.

Figure 31 is a view taken along lines 31-31of Figure 30.

Figure 32 is a cross-sectional view taken along lines 32-32 of figure 30.

Figure 33 is a greatly enlarged generally perspective view of the central support member of the connector apparatus shown in figure 30.

Figure 34 is a front view of still another form of connector apparatus of the invention for connecting an elevator guide rail to a horizontally extending beam.

Figure 35 is a cross-sectional view taken along lines 36-36 of figure 34.

Figure 36 is a view taken along lines 21-21 of figure 20.

Figure 37 is an enlarged generally perspective view of the support member of the connector apparatus shown in figure 34.

Figure 38 is a front view of yet another form of elevator rail support system in which the elevator support rails are adjustably connected to a specially configured bracket that spans a pair of spaced apart vertical beams.

Figure 39 is a cross-sectional view taken along lines 39-39 of figure 38.

Figure 40 is a view taken along lines 40-40 of figure 38.

Figure 41 is a generally perspective view of the specially configured bracket of the connector apparatus shown in figure 38.

Figure 42 is a front view of yet another form of rail support system of the invention that is adapted to be connected to a wall of the hoistway.

Figure 43 is a cross-sectional view taken along lines 43-43 of figure 42.

Figure 44 is a cross-sectional view taken along lines 44-44 of figure 42.

Figure 45 is a generally perspective view of the specially configured brackets of the connector apparatus shown in figure 42.

Description of the Invention

Referring to the drawings and particularly to figures 1A and 1B, several forms of the connector apparatus of the present invention for interconnecting guide rails in elevator systems with various types of structural components is there illustrated. In the area of figure 1A designated by the letter A, a connector apparatus for interconnecting the guide rails of a counterweight system with two pair of vertically extending columns is there illustrated. Shown in the area designated by the letter B in figure 1B is a connector apparatus for interconnecting the guide rails of a counterweight system with one wall of the building structure that houses the elevator system. In the area of figure 1A designated by the letter C there is shown a connector

apparatus for interconnecting a guide rail of an elevator system with one wall of the building structure that houses the elevator system. In the area designated by the letter D in figure 1A is a connector apparatus for interconnecting the guide rails of an elevator system with a pair of vertically extending columns. Shown in the area designated by the letter E in figure 1B is a connector apparatus for interconnecting the guide rails of an elevator system with a horizontally extending beam. In the area designated by the letter F in figure 1B is another form of connector apparatus for interconnecting the guide rail of an elevator system with a pair of vertically extending columns.

Considering first the connector apparatus shown in the area of figure 1A that is designated by the letter A, this connector apparatus comprises two identical connector assemblies 15 that function to interconnect the guide rails R of a counterweight system with structural components, here comprising two pair of vertically extending beams or columns generally designated by the numerals 14 and 14a. Referring to figure 2, where the construction of one of the two identical connector assemblies 15 is illustrated, each connector assembly 15 of this form of the invention can be seen to comprise first, second, third, and fourth spaced-apart right angle brackets 16, 18, 20, and 22 respectively. Each of the first and second spaced-apart angle brackets 16 and 18 has a first generally planar, outwardly extending leg 24 that has an

aperture 26 formed therein and a second perpendicularly extending second leg 28 that has an aperture 30 extending there through.

Also forming a part of the connector apparatus of the invention is a first elongated spanner plate 32 that spans the spaced-apart, vertically extending columns 14. Plate 32 has a first face 32a that engages the outer faces of the columns 14 and a second face 33b that engages faces 28a of the angle brackets 28. Interconnecting the first legs 24 of first and second angle brackets 16 and 18 is a tie bolt 36. Tie bolt 36 extends through the apertures 26 formed in legs 16 and 18 and is secured in position by a locking nut 39. In the present form of the invention, angle brackets 16, 18, 20 and 22, along with spanner plate 32, comprise the interconnection means of the invention for adjustably interconnecting a first connector bracket, that is generally designated in the drawings by the numeral 42, with the structural components which here comprise columns 14 and 14a.

Disposed in engagement with faces 14b of the vertically extending beams 14 is the first leg 42a of first connector bracket 42. As illustrated in figure 2, leg 42a is disposed between faces 14b of columns 14 and faces 20a and 22a of angle brackets 20 and 22 respectively. A second tie bolt 46 interconnects the first legs 20b and 22b of third and fourth angle brackets 20 and 22. Tie bolt 46, that has a threaded end 46a, extends through apertures 20c

and 22c formed in legs 20b and 22b of the angle brackets 20 and 22 and is secured in position by a locking nut 47.

In order to urge leg 42a of connector bracket 42 into secure engagement with columns 14, third and fourth eyebolts 50 and 52 are interconnected with the angle brackets in the manner shown in figure 2. More particularly, eyebolt 50 functions to interconnect leg 28 of first angle bracket 16 with leg 20d of second angle bracket 20, while eyebolt 52 functions to interconnect leg 28 of second angle bracket 18 with leg 22d of fourth angle bracket 22. Eyebolt 50, that has a threaded end 50a, extends through an aperture 20e formed in bracket 20, through an aperture 43 formed in leg 42a of bracket 42, through an aperture 32b formed in spanner plate 32 and finally through the aperture 30 formed in leg 28 of angle bracket 16. Eyebolt 50 is held in position by means of a locking nut 53. In similar fashion, eyebolt 52, that has a threaded end 52a, extends through an aperture 22e formed in leg 22d of bracket 22, through an elongated aperture 55 formed in leg 42a of connector plate 42, through an elongated aperture 32c formed in spanner plate 32 and finally through the aperture 30 formed in leg 28 of angle bracket 18. Eyebolt 52 is held in position by means of a locking nut 57. Elongated apertures 55 and 32c permit longitudinal adjustment of brackets 18 and 22 to accommodate for variations in the spacing of columns 14.

As best seen in figure 4, first connector bracket 42 has a second leg 42b that extends generally perpendicularly to leg 42a. Formed within second leg 42 of connector bracket 42 are first and second sets of through holes 59 and 61, the purpose of which will presently be described. Holes 59 are disposed along a first line 62 that extends at an acute angle with respect to first leg 42a of connector bracket 42. Similarly, through holes 61 are disposed along a second line 64 that extends at an acute angle with respect to first leg 42a of connector bracket 42. Each of the through holes 59 and 61 are generally rectangular in plan and are of a size and shape to closely receive the square shank portion of threaded connector bolts which, in a manner presently to be described, are used to interconnect a second connector bracket 66 with bracket 42.

Second connector bracket 66, which functions to adjustably support one of the counterweight rails "R", is adjustably interconnected with first connector bracket 42 in a manner now to be described. Like bracket 42, connector bracket 66 is provided with first and second sets of through holes 67 and 69. Holes 67 are disposed along a third line 70 that extends at an acute angle with respect to first leg 66a of connector bracket 66 and also angularly with respect to line 64. Similarly, through holes 69 are disposed along a fourth line 72 that extends angularly with respect to first leg 66a of connec-

tor bracket 66 and also angularly with respect to line 62. Each of the through holes 67 and 69 are also generally rectangular in plan and are of a size and shape to closely receive the square shank portion of the threaded connector bolts.

Through holes 67 formed in bracket 66 are so constructed and arranged that a selected one of the through holes 67 can be moved into index with a selected one of the through holes 61 formed in bracket 42 by a sliding movement of bracket 66 relative to bracket 42. Similarly, through holes 69 formed in bracket 66 are constructed and arranged so that a selected one of the through holes 69 can be moved into index with a selected one of the through holes 59 formed in bracket 42 when bracket 66 is moved from a first position to a second position relative to bracket 42. More particularly, bracket 66 can be slidably moved relative to bracket 42 in a first transverse direction generally parallel with leg 42a of bracket 42 or, alternatively, can be slidably moved in a second direction generally perpendicular to leg 42a of bracket 42.

When second connector bracket 66 is correctly aligned with first connector bracket 42 and a selected one of the though holes 67 is indexably aligned with a selected one of the through holes 61, a first connector bolt, such as a bolt 72, can be introduced into the aligned through holes. Simi-

larly, when the connector bracket 66 is correctly aligned with bracket 42 and a selected one of the through holes 69 is indexably aligned with a selected one of the through holes 59, a second bolt, such as connector a bolt 74, can be introduced into the aligned through holes. With the bolts 72 and 74 in position with the square shank portions 75 thereof (figure 4) closely received within the aligned holes, nuts such as nut 77 can be used to securely interconnect connector bracket 66 with bracket 42 in the manner shown in figures 2 and 3. When the brackets are thusly connected, the square shaped shank portions 75 of the bolts will be snugly received within the indexably aligned through holes in the two brackets and will efficiently prevent sliding movement between the brackets even under severe seismic loading.

Also forming a part of the connector apparatus of the form of the invention shown in figures 1A and 2 are rail connector means for adjustably interconnecting the guide rail "R" of the counterweight system to leg 66a of second connector bracket 66. In the present form of the invention, this connector means comprises a pair of spaced apart connector clips 74 that are adjustably connected to second legs 66a of connector bracket 66 by threaded bolts 75. Each connector clip 74 has a rail engagement leg 74a that is adapted to clampingly engage the legs R-1of the guide rail R.

It is to be noted that second leg 66a of connector bracket 66 is provided with spaced-apart, outwardly extending walls 76 and 76a, each of which is provided with a bore 77 that is adapted to receive the shank of a threaded jackbolt 78. Jackbolts 78 are threadably received within an adjustment nut 79 that is connected to each of the jackbolts. Adjustment nuts 79 bear upon the outer surface of walls 76 so that, when the jackbolts are threaded inwardly and outwardly with respect to nuts 79, clips 74 can be adjusted longitudinally of leg 66a. In this regard, each of the jackbolts 78 terminates in an end 78a that is in engagement with a selected one of the connector clips 74 so that by loosening bolts 75 and threading the jackbolts inwardly and outwardly relative to nuts 79, clips 74 can be moved into and out of clamping engagement with legs R-1 of rail R. To permit this adjustment, leg 66a of bracket 66 is provided with a pair of spaced-apart slots 79 that accept the shank portion of the connector bolts 75. It is apparent that by loosening locking nuts 80, clips 74 can be moved toward and away from guide rail R in the direction of the arrows of figure 2 and can be securely locked in position by tightening jack bolts 78 and then by retightening locking nuts 80. It is to be understood that when the apparatus of the invention is installed within the hoistway in the manner shown in Figure 1A, the various degrees of adjustment available to the installer permits the installer to precisely lo-

cate the guide rails R in an optimum position to permit smooth and efficient operation of the counterweight system.

Referring next to figures 5 through 7, one of the two connector assemblies 82 shown in area "B" of figure 1B is shown in enlarged form. As indicated in figure 1B, this alternate form of the connector apparatus of the invention is used for interconnecting a pair of guide rails of a counterweight system with a structural component, here comprising a supporting structure such as a wall W-1 of the structure that houses the elevator hoistways. As best seen in figure 5, each of the connector assemblies 82 of this latest form of the invention comprises a first connector bracket 84 having a first generally planar first leg 86 that is connected to the supporting structure W-1 by interconnection means, the character of which will presently be described. Leg 86 extends generally perpendicularly from a second leg 87 that has a generally planar surface 87a. Leg 86 is provided with four spaced-apart apertures 88, 90, 92 and 94. Received within apertures 90 and 92 are the threaded shank portions 96a of a pair of anchor bolts 96, the body portions 96b of which are embedded within the concrete of the supporting wall W-1. The threaded shank portions 96a of bolts 96 extend through apertures 90 and 92 and are interconnected with leg 86 of bracket 84 by locking nuts 100 respectively.

Receivable within apertures 88 and 94 are a pair of threaded jackbolts 104 and 106. The extremities of each of the jackbolts 104 and 106, which are generally designated by the numerals 104a and 106a respectively, are adapted to pressurally engage the external surface of the supporting wall W-1 in the manner shown in figure 5. Jackbolts 104 and 106 are each threadably received within an adjustment nut 110 that is connected to each of the jackbolts. Adjustment nuts 110 bear upon the outer surface 86a of leg 86 of bracket 84 so that, when the jackbolts 104 and 106 are threaded inwardly and outwardly with respect to nuts 110, first bracket 84 can be adjustably moved relative to the outer surface of support wall W-1 in a manner to adjust the spacing of first bracket 84 relative to the support wall W-1.

Anchor bolts 96 and jack bolts 104 and 106 comprise the interconnection means of this form of the invention for adjustably interconnecting bracket 84 with the structural component or wall W-1.

Second leg 87 of bracket 84 is provided with a plurality of first through holes 112 that are disposed along a first line 114 that extends at an acute angle with respect to first leg 86. Similarly, leg 87 is provided with a second set of first through holes 116 that are disposed along a second line 118 that extends at an acute angle with respect to first leg 86.

Adjustably interconnected with first connector bracket 86 is a second connector bracket 120. Second bracket 120 has a first leg 122 and a second leg 124 that extends generally perpendicular to first leg 122. As illustrated in figure 5, first leg 122 is provided with a pair of spaced-apart, outwardly extending side walls 126 and 128 each of which is provided with a bore 130, the purpose of which will presently be described.

As best seen in figure 7, second bracket 120 is also provided with a plurality of through holes 132 that are disposed along a third line 133 that extends at an acute angle with respect to first leg 122 and with respect to line 118. Similarly, leg 124 is provided with another set of through holes 134 that are disposed along a fourth line 136 that extends at an acute angle with respect to first leg 122 and with respect to line 133. Through holes 132 formed in bracket 120 are so constructed and arranged that a selected one of the through holes 132 can be moved into index with a selected one of the through holes 112 formed in bracket 84 by a sliding movement of bracket 120 relative to bracket 84. Similarly, through holes 134 formed in bracket 120 are constructed and arranged so that a selected one of the through holes 134 can be moved into index with a selected one of the through holes 116 formed in bracket 84 when bracket 120 is slidably moved from a first position to a second position relative to bracket 84. More particularly, bracket

120 can be slidably moved relative to bracket 84 in a first direction generally parallel with leg 86 of bracket 84 or, alternatively, can be slidably moved in a second direction generally perpendicular to leg 86 of bracket 84.

When second connector bracket 120 is correctly aligned with first connector bracket 84 and a selected one of the though holes 132 is indexably aligned with a selected one of the through holes 112, a first bolt, such as a bolt 138, can be introduced into the aligned through holes. Similarly, when the connector bracket 120 is correctly aligned with bracket 84 and a selected one of the through holes 134 is indexably aligned with a selected one of the through holes 116, a second bolt, such as a bolt 140, can be introduced into the aligned through holes. With the bolts 138 and 140 in position with the square shank portions 141 thereof (figure 7) closely received within the aligned holes, nuts such as nut 143 can be used to securely interconnect connector bracket 120 with bracket 84 in the manner shown in figures 5 and 7. When the brackets are thusly connected, the square shaped shank portions 141 of the bolts will be snugly received within the indexably aligned through holes in the two brackets and will efficiently prevent sliding movement between the brackets.

The connector apparatus of this latest form of the invention further includes connector means for connecting the guide rails of the counterweight

system shown in figure 1B to first leg 122 of second bracket 120 in the manner illustrated in figures 5 and 6. In this latest form of the invention, the connector means comprises first and second spaced-apart connector clips 144 that are of a similar construction to the earlier identified connector clips 74. Connector clips 124 are adjustably connected to first leg of connector bracket 120 by threaded bolts 145. Each connector clip 144 has a rail engagement leg 144a that is adapted to clampingly engage the legs R-1of the guide rail R. Bores 130 formed in outwardly extending walls 126 and 128 of leg 122 are adapted to receive a threaded jackbolt 150. Jackbolts 150 are each threadably received within an adjustment nut 151. Adjustment nuts 151 bear upon the outer surface of walls 126 and 128 so that, when the jackbolts are threaded inwardly and outwardly with respect to nuts 151, clips 144 can be adjusted relative to leg 122. Each of the jackbolts 150 terminates in an end 150a that is in engagement with a selected one of the connector clips 144 so that by loosening bolts 145 and threading the jackbolts inwardly and outwardly relative to nuts 151, clips 144 can be moved into and out of clamping engagement with legs R-1 of rail R. To permit this adjustment, leg 122 of bracket 120 is provided with a pair of spaced-apart slots 152 that accept the shank portion of the connector bolts 145. It is apparent that by loosening locking nuts 145a, clips 144 can be moved toward and away from

guide rail R in the direction of the arrows of figure 5 and can be securely locked in position by tightening jack bolts 150 and then by retightening locking nuts 145a.

It is to be understood that when the apparatus of the invention is installed within the hoistway in the manner shown in Figure 1B, the various degrees of adjustment available to the installer permits the installer to precisely locate the counterweight guide rails in an optimum position to permit smooth and efficient operation of the counterweight system.

Considering next the embodiment of the invention shown in area "C" of figure 1A, this embodiment comprises a connector apparatus for interconnecting a guide rail of an elevator system with a wall W-2 of the building structure that houses the elevator system. As best seen in figure 9, the connector assembly 158 of this latest form of the invention comprises a first connector bracket 160 having a first generally planar first leg 162 that is connected to a structural component, here shown as the supporting structure W-2. As before, connector bracket 160 is adjustably interconnected with structure W-2 by interconnection means the character of which will presently be described. Leg 162 extends generally perpendicularly from a second leg 164 that has a generally planar surface 164a. Leg 164 is provided with four spaced-apart apertures 166, 168, 170 and 172. Received within

apertures 168 and 170 are the threaded shank portions 174a of a pair of anchor bolts 170, the body portions 174b of which are embedded within the concrete of the supporting wall W-2. The threaded shank portions 174a of bolts 174 extend through apertures 168 and 170 and are interconnected with leg 162 of bracket 160 by locking nuts 177 respectively.

Receivable within apertures 166 and 172 are threaded jackbolts 178 and 180 respectively. The extremities of each of the jackbolts 178 and 180, which are generally designated by the numerals 178a and 180a respectively, are adapted to pressurally engage the external surface of the supporting wall W-2 in the manner shown in figure 9. Jackbolts 178 and 180 are each threadably received within an adjustment nut 183 that is connected to each of the jackbolts. Adjustment nuts 183 bear upon the outer surface 162a of leg 162 of bracket 160 so that, when the jackbolts are threaded inwardly and outwardly with respect to nuts 183, first bracket 160 can be adjustably moved relative to the outer surface of support wall W-2 in a manner to adjust the spacing of first bracket 160 relative to the support wall W-2. Anchor bolts 170 along with jack bolts 178 and 180 comprise the interconnection means of this latest form of the invention.

Second leg 164 of bracket 160 is provided with a plurality of first through holes 186 that are disposed along a first line 188 that extends at an

angle with respect to first leg 162. Similarly, leg 164 is provided with a second set of first through holes 190 that are disposed along a second line 192 that extends at an angle with respect to first leg 162. Adjustably interconnected with first connector bracket 160 is a second connector bracket 194. Second bracket 194 has a first leg 196 and a second leg 198 that extends generally perpendicular to first leg 196. As illustrated in figure 9, a pair of spaced-apart walls 202 and 204 extend outwardly from leg 196 and each is provided with a threaded bore 206, the purpose of which will presently be described.

As best seen in figure 9, leg 198 of second bracket 194 is also provided with a plurality of through holes 208 that are disposed along a third line 210 that extends at an angle with respect to first leg 196 and with respect to line 88. Similarly, leg 198 is provided with another set of through holes 212 that are disposed along a further line 214 that extends at an angle with respect to first leg 196 and with respect to line 192. Through holes 208 formed in bracket 164 are so constructed and arranged that a selected one of the through holes 208 can be moved into index with a selected one of the through holes 186 formed in bracket 160 by a sliding movement of bracket 194 relative to bracket 160. Similarly, through holes 212 formed in bracket 194 are constructed and arranged so that a selected one of the through holes

212 can be moved into index with a selected one of the through holes 190 formed in bracket 160 when bracket 194 is slidably moved from a first position to a second position relative to bracket 160. More particularly, bracket 194 can be slidably moved relative to bracket 160 in a first direction generally parallel with leg 162 of bracket 160 or, alternatively, can be slidably moved in a second direction generally perpendicular to leg 162 of bracket 160.

When second connector bracket 194 is correctly aligned with first connector bracket 160 and a selected one of the though holes 208 is indexably aligned with a selected one of the through holes 186, a first bolt, such as a bolt 217, can be introduced into the aligned through holes. Similarly, when the connector bracket 194 is correctly aligned with bracket 160 and a selected one of the through holes 212 is indexably aligned with a selected one of the through holes 190, a second bolt, such as a bolt 219, can be introduced into the aligned through holes. With the bolts 217 and 219 in position with the square shank portions 222 thereof (figure 8) closely received within the aligned holes, nuts, such as nut 224 can be used to securely interconnect connector bracket 194 with bracket 160 in the manner shown in figures 8 and 9. When the brackets are thusly connected, the square shaped shank portions 222 of the bolts will be snugly received within the indexably

aligned through holes in the two brackets and will efficiently prevent sliding movement between the brackets.

As in the earlier described embodiment, the connector apparatus of this latest form of the invention includes connector means for connecting the guide rail ER of the elevator system shown in figure 1A to first leg 196 of second bracket 194 in the manner illustrated in figures 8 and 9. In this latest form of the invention, the connector means comprises first and second spaced-apart connector clips 228 that are of a similar construction to the earlier identified connector clips 74. Connector clips 228 are adjustably connected to first leg of connector bracket 194 by threaded bolts 229. Each connector clip 228 has a rail engagement leg 228a that is adapted to clampingly engage the legs ER-1of the guide rail ER.

Bores 206 formed in outwardly extending walls 202 and 204 are adapted to threadably receive a threaded jackbolt 232. Jackbolts 232 are threadably received within an adjustment nut 233 that is connected to each of the jackbolts. Adjustment nuts 233 bear upon the outer surfaces of walls 202 and 204 so that, when the jackbolts are threaded inwardly and outwardly with respect to nuts 233, the connector clips can be adjustably moved relative to leg 196. Each jack bolt 232 has an end 232a that is in engagement with a selected one of the connector clips 228 so that by loosening bolts 229

and threading the jackbolts inwardly and outwardly relative to walls 202 and 204, clips 228 can be moved into and out of clamping engagement with legs ER-1 of rail ER. To permit this adjustment, leg 196 of bracket 194 is provided with a pair of spaced-apart slots 235 that accept the shank portion of the connector bolts 229. It is apparent that by loosening locking nuts 229a, clips 228 can be moved toward and away from guide rail ER and can be securely locked in position by tightening jack bolts 232 and then by retightening locking nuts 229a.

It is to be understood that when the apparatus of the invention is installed within the hoistway in the manner shown in Figure 1A, the various degrees of adjustment available to the installer permits the installer to precisely locate the guide rail ER in an optimum position relative to the elevator car EC-1.

Referring next the embodiment of the invention shown in area "D" of figure 1A, this embodiment comprises a connector apparatus for interconnecting the guide rails ER-1 and ER-2 of an elevator system with structural components shown here as a pair of spaced apart vertically extending beams or columns 250. As best seen in figure 12, this connector apparatus comprises two connector assemblies 252 and 252a that function to interconnect

the guide rails ER-1 and ER-2 of the elevator system with the pair of vertically extending beams 250.

As shown in figure 12, connector assembly 252 of this latest form of the invention comprises first and second spaced-apart right angle brackets 254 and 256. Bracket 254 has a first generally planar, outwardly extending leg 258 that has an aperture 260 formed therein and a second perpendicularly extending second leg 262 that has an aperture 264 extending there through. Bracket 256 also has a first generally planar, outwardly extending leg 266 that has an aperture 268 formed therein and a second perpendicularly extending second leg 270 that has an aperture 272 extending there through.

Maintained in engagement with faces 250a of the vertically extending beams 250 by the interconnection means of the invention is the first leg 274a of an elongated, first connector bracket that is generally designated in the drawings by the numeral 274. More particularly, leg 274a of bracket 274 has a first face 275 that engages the outer faces of the columns 250 and a second face 277 that engages the inner faces of legs 262 and 270. Leg 274a of bracket 274 is also provided with an aperture 279 and a slot 281, the purpose of which will presently be described. Interconnecting legs 258 and 266 of first and second angle brackets 256 and 258 is a tie bolt 278. Tie bolt 278

extends through apertures 260 and 268 formed in legs 256 and 258 and is secured in position by a locking nut 279. In this latest form of the invention, angle brackets 256 and 258 comprise part of the interconnection means of the invention for interconnecting first connector bracket 274 with beams 250.

As best seen in figure 12, first connector bracket 274 has a second leg 274b that extends generally perpendicularly to leg 274a. Formed within second leg 274b of connector bracket 274 are first and second sets of through holes 282 and 284, the purpose of which will presently be described. Holes 282 are disposed along a first line 286 that extends angularly with respect to first leg 274a of connector bracket 274. Similarly, through holes 284 are disposed along a second line 288 that extends angularly with respect to first leg 274a of connector bracket 274. Each of the through holes 282 and 284 are generally rectangular in plan and are of a size and shape to closely receive the square shank portion of threaded connector bolts which, in a manner presently to be described, are used to interconnect a second connector bracket 290 with bracket 274.

Second connector bracket 290, which functions to adjustably support rail ER-2, is adjustably interconnected with first connector bracket 274 in a manner now to be described. Like bracket 274, leg 290b of connector

bracket 290 is provided with first and second sets of through holes 292 and 294. Holes 292 are disposed along a third line 296 that extends angularly with respect to first leg 290a of connector bracket 290 and also angularly with respect to line 286. Similarly, through holes 294 are disposed along a fourth line 298 that extends angularly with respect to first leg 290a of connector bracket 290 and also angularly with respect to line 288. Each of the through holes 292 and 294 are also generally rectangular in plan and are of a size and shape to closely receive the square shank portion of the threaded connector bolts.

Through holes 292 formed in bracket 294 are so constructed and arranged that a selected one of the through holes 292 can be moved into index with a selected one of the through holes 282 formed in bracket 274 by a sliding movement of bracket 290 relative to bracket 274. Similarly, through holes 294 formed in bracket 290 are constructed and arranged so that a selected one of the through holes 294 can be moved into index with a selected one of the through holes 284 formed in bracket 274 when bracket 290 is moved from a first position to a second position relative to bracket 274. More particularly, bracket 290 can be slidably moved relative to bracket 274 in a first direction generally parallel with leg 274a of bracket 274 or, alterna-

tively, can be slidably moved in a second direction generally perpendicular to leg 274a of bracket 274.

When second connector bracket 290 is correctly aligned with first connector bracket 274 and a selected one of the though holes 292 is indexably aligned with a selected one of the through holes 282, a first bolt, such as a bolt 301, can be introduced into the aligned through holes. Similarly, when the connector bracket 290 is correctly aligned with bracket 274 and a selected one of the through holes 294 is indexably aligned with a selected one of the through holes 284, a second bolt, such as a bolt 303, can be introduced into the aligned through holes. With the bolts 301 and 303 in position with the square shank portions 306 thereof (figure 13) closely received within the aligned holes, nuts such as nut 308 can be used to securely interconnect connector bracket 290 with bracket 274 in the manner shown in figures 10, 11 and 12. When the brackets are thusly connected, the square shaped shank portions 306 of the bolts will be snugly received within the indexably aligned through holes in the two brackets and will efficiently prevent sliding movement between the brackets.

Also forming a part of the connector apparatus of the form of the invention shown in figures 1A and 12 are connector means for interconnecting the guide rail ER-2 of the elevator system to leg 290a of second connector

bracket 290. In the present form of the invention, this connector means comprises a pair of spaced apart connector clips 310 that are connected to second leg 290a of connector bracket 290 by threaded bolts 312. Each connector clip 310 has a rail engagement leg 310a that is adapted to clampingly engage the legs of the guide rail R-3 in the manner shown in figure 12.

As shown in figure 12, connector assembly 252a of this latest form of the invention is of a similar construction to connector assembly 252 and comprises first and second spaced-apart right angle brackets 314 and 316. Bracket 314 has a first generally planar, outwardly extending leg 318 that has an aperture 320 formed therein and a second perpendicularly extending second leg 322 that has an aperture 324 extending there through. Bracket 316 also has a first generally planar, outwardly extending leg 326 that has an aperture 328 formed therein and a second perpendicularly extending second leg 330 that has an aperture 332 extending there through.

Maintained in engagement with faces 250b of the vertically extending beams 250 by the interconnection means is the first leg 334a of an elongated, first connector bracket that is generally designated in the drawings by the numeral 334. More particularly, leg 334a of bracket 334 has a first face 335 that engages the outer faces of the columns 250 and a second face 337 that engages the inner faces of legs 322 and 330. Leg 334a of bracket 334 is

also provided with an aperture 339 and a slot 341, the purpose of which will presently be described. Interconnecting legs 318 and 326 of first and second angle brackets 316 and 318 is a tie bolt 338. Tie bolt 338 extends through apertures 320 and 328 formed in legs 316 and 318 and is secured in position by a locking nut 339.

As best seen in figure 12, first connector bracket 334 has a second leg 334b that extends generally perpendicularly to leg 334a. Formed within second leg 334b of connector bracket 334 are first and second sets of through holes 342 and 344, the purpose of which will presently be described. Holes 342 are disposed along a first line 346 that extends angularly with respect to first leg 334a of connector bracket 334. Similarly, through holes 344 are disposed along a second line 348 that extends angularly with respect to first leg 334a of connector bracket 334. Each of the through holes 342 and 344 are generally rectangular in plan and are of a size and shape to closely receive the square shank portion of threaded connector bolts which, in a manner presently to be described, are used to interconnect a second connector bracket 350 with bracket 334.

Second connector bracket 350, which functions to adjustably support rail R-2, is adjustably interconnected with first connector bracket 334 in a manner now to be described. Like bracket 334, leg 350b of connector

bracket 350 is provided with first and second sets of through holes 352 and 354. Holes 352 are disposed along a third line 356 that extends angularly with respect to first leg 350a of connector bracket 350 and also angularly with respect to line 346. Similarly, through holes 354 are disposed along a fourth line 358 that extends angularly with respect to first leg 350a of connector bracket 350 and also angularly with respect to line 348. Each of the through holes 352 and 354 are also generally rectangular in plan and are of a size and shape to closely receive the square shank portion of the threaded connector bolts.

Through holes 352 formed in bracket 354 are so constructed and arranged that a selected one of the through holes 352 can be moved into index with a selected one of the through holes 342 formed in bracket 334 by a sliding movement of bracket 350 relative to bracket 334. Similarly, through holes 354 formed in bracket 350 are constructed and arranged so that a selected one of the through holes 344 formed in bracket 334 when bracket 350 is moved from a first position to a second position relative to bracket 334. More particularly, bracket 350 can be slidably moved relative to bracket 334 in a first direction generally parallel with leg 334a of bracket 334 or, alternatively, can be slidably moved in a second direction generally perpendicular to leg 334a of bracket 334.

When second connector bracket 350 is correctly aligned with first connector bracket 334 and a selected one of the through holes 352 is indexably aligned with a selected one of the through holes 312, a first bolt, such as a bolt 361, can be introduced into the aligned through holes. Similarly, when the connector bracket 350 is correctly aligned with bracket 334 and a selected one of the through holes 354 is indexably aligned with a selected one of the through holes 344, a second bolt, such as a bolt 363, can be introduced into the aligned through holes. With the bolts 361 and 363 in position with the square shank portions thereof closely received within the aligned holes, nuts such as nut 368 can be used to securely interconnect connector bracket 350 with bracket 334 in the manner shown in figures 10, 11 and 12. When the brackets are thusly connected, the square shaped shank portions of the bolts will be snugly received within the indexably aligned through holes in the two brackets and will efficiently prevent sliding movement between the brackets. Brackets 254, 256, 314 and 316, along with tie bolts 373, 373a, 278, and 338 comprise the interconnection means of this latest embodiment for maintaining brackets 274 and 334 in engagement with the structural components or beams 250.

Also forming a part of the connector apparatus of the form of the invention shown in figures 1A and 12 are connector means for interconnecting

the guide rail ER-1 of the elevator system to leg 350a of second connector bracket 350. In the present form of the invention, this connector means comprises a pair of spaced apart connector clips 370 that are connected to second leg 350a of connector bracket 350 by threaded bolts 372. Each connector clip 370 has a rail engagement leg 370a that is adapted to clampingly engage the legs of the guide rail R-2 in the manner shown in figure 12.

As shown in figure 12, assemblies 252 and 252a are connected together by a pair of tie bolts 373 and 373a. Tie bolt 373 extends through apertures 264 and 324 formed in brackets 254 and 314 respectively. Tie bolt 373a extends through apertures 272 and 332 of angle brackets 256 and 316. Tie bolt 373 also extends through apertures 279 and 339 formed in legs 274a and 334a of brackets 274 and 334. Tie bolt 373a also extends through slots 281 and 341 formed in legs 274a and 334a of legs 274a and 334a of brackets 274 and 334. Because of the configuration of slots 281 and 341, angle brackets 256 and 316 are free to move longitudinally of brackets 274 and 334 to accommodate for any misalignment of rails R-2 and R-3. In this latest form of the invention, angle brackets 314 and 316, along with tie bolts 373 and 373a comprise the beam interconnection means of the invention for interconnecting connector bracket 334 with beams 373 and 373a.

Considering now the embodiment of the invention shown in figures 14, 15, and 16. This embodiment is similar to the last described embodiment and comprises a connector apparatus for interconnecting the guide rails ER-3 and ER-4 of an elevator system with structural components shown here as a pair of spaced apart vertically extending beams 380 (not shown in figures 1A and 1B). As best seen in figure 16, this connector apparatus comprises two substantially identical connector assemblies 382 and 382a that are interconnected by two substantially identical adjustment subassemblies 383. In a manner presently to be described, the several cooperating assemblages just described function to interconnect the guide rails ER-3 and ER-4 of the elevator system with the pair of vertically extending beams 380.

As shown in figure 16, each of the connector assemblies 382 and 382a of this latest form of the invention comprises a first connector bracket 384 and a second connector bracket 386 that is adjustably connected to first bracket 384. In a manner presently to be described, adjustment assemblies 383, which here comprise the interconnection means of this latest form of the invention, maintain the first leg 384a of each of the brackets 384 in pressural engagement with faces 380a of the horizontally extending beams 380.

The second leg 384b of bracket 384, which leg extends generally perpendicularly to leg 384a is provided with first and second sets of through

holes 392 and 394, the purpose of which will presently be described. Holes 392 are disposed along a first line 396 that extends angularly with respect to first leg 384a of connector bracket 384. Similarly, through holes 394 are disposed along a second line 398 that extends angularly with respect to first leg 384a of connector bracket 384. Each of the through holes 392 and 394 are generally rectangular in plan and are of a size and shape to closely receive the square shank portion of threaded connector bolts which, in a manner presently to be described, are used to interconnect a second connector bracket 386 with bracket 384.

Second connector bracket 386, which functions to adjustably support rail ER-3, is adjustably interconnected with first connector bracket 274 in a manner now to be described. Like bracket 384, leg 386a of connector bracket 386 is provided with first and second sets of through holes 402 and 404. Holes 402 are disposed along a third line 406 that extends angularly with respect to second leg 386b of connector bracket 386 and also angularly with respect to line 396. Similarly, through holes 404 are disposed along a fourth line 408 that extends angularly with respect to leg 386 of connector bracket 386 and also angularly with respect to line 398. Each of the through holes 402 and 404 of brackets 382 and 382a are also generally rectangular in

plan and are of a size and shape to closely receive the square shank portion of the threaded connector bolts.

Through holes 402 formed in brackets 294 are so constructed and arranged that a selected one of the through holes 402 can be moved into index with a selected one of the through holes 392 formed in brackets 386 by a sliding movement of the brackets 386 relative to the brackets 384. Similarly, through holes 404 formed in brackets 386 are constructed and arranged so that a selected one of the through holes 404 can be moved into index with a selected one of the through holes 404 formed in bracket 384 when brackets 386 are moved from a first position to a second position relative to bracket 384. More particularly, brackets 386 can be slidably moved relative to brackets 384 in a first direction generally parallel with legs 384a of bracket 384 or, alternatively, can be slideably moved in a second direction generally perpendicular to legs 384a of bracket 384.

As best seen by referring to figure 16, the interconnection means or adjustment assemblies 383 of this latest form of the invention comprise a generally U-shaped bracket 420 having a bight portion 420a and first and second spaced-apart legs 420b. The connector assembly also includes a tie bolt 422, the shank portion 422a of which is received within apertures 424 provided in legs 384a of brackets 384. The shank portion of the tie bolt also

extends through apertures provided in legs 420b of U-shaped member 420 in the manner shown in figure 16. A locking nut 426 secures bolt 422 in position and, when tightened, urges brackets 384 into pressural engagement with the faces of the spaced-apart beams or columns 380.

Each of the U-shaped members 420 of the two identical adjustment assemblies 383 is provided with a pair of spaced-apart apertures 428 that receive jackbolts 430. Jackbolts are threadably received within nuts 432 that bear on the outer surfaces of bight portion 420a of the U-shaped member 420. Each of the jackbolts 430 terminates in an end 430a which is adapted to engage the outwardly facing walls of beams 380 in the manner shown in figure 16. It is apparent that, with the construction shown, by first loosening nuts 426 and then by threadably adjusting jackbolts 430, brackets 384 can be adjustably moved relative to columns 380 in the direction of the arrows 434 of figure 16. Once in the desired position, nuts can be retightened and jackbolts 430 will function to securely position the assemblages 382 and 382a in engagement with beams 380.

It is to be understood that when this latest embodiment of the apparatus of the invention is installed within the elevator hoistway, the various degrees of adjustment available to the installer permits the installer to precisely

locate the guide rails ER-3 and ER-4 in an optimum position relative to the elevator cars with which they are associated.

Referring next the embodiment of the invention shown in area "F" of figure 1B, this embodiment, which is somewhat similar to the last two described embodiments, comprises a connector apparatus for interconnecting the guide rail R-6 of an elevator system with a pair of spaced apart vertically extending columns 440. As seen in figures 16A and 16B, this embodiment includes a connector assembly 442 that is substantially identical to the connector assembly 252a as shown in figure 12. This being the case, like numerals are used in figures 16A and 16B to identify like components.

As best seen in figure 16B, connector assembly 442 of this latest form of the invention comprises first and second spaced-apart right angle brackets 314 and 316. Bracket 314 has a first generally planar, outwardly extending leg 318 that has an aperture 320 formed therein and a second perpendicularly extending second leg 322 that has an aperture 324 extending there through. Bracket 316 also has a first generally planar, outwardly extending leg 326 that has an aperture 328 formed therein and a second perpendicularly extending second leg 330 that has a slot 443 extending there through. Disposed in engagement with faces 440b of the vertically extending beams 440 is the first leg 334a of an elongated, first connector bracket that is gen-

erally designated in the drawings by the numeral 334. More particularly, leg 334a of bracket 334 has a first face 335 that engages the outer faces of the columns 440 and a second face 337 that engages the inner faces of legs 322 and 330. Leg 334a of bracket 334 is also provided with an apertures 445 and 447, the purpose of which will presently be described. Interconnecting legs 318 and 326 of first and second angle brackets 316 and 318 is a tie bolt 338. Tie bolt 338 extends through apertures 320 and 328 formed in legs 316 and 318 and is secured in position by a locking nut 339.

As shown in figure 16A, first connector bracket 334 has a second leg 334b that extends generally perpendicularly to leg 334a. Formed within second leg 234b of connector bracket 334 are first and second sets of through holes 342 and 344, the purpose of which will presently be described. Holes 342 are disposed along a first line 346 that extends angularly with respect to first leg 334a of connector bracket 334. Similarly, through holes 344 are disposed along a second line 348 that extends angularly with respect to first leg 334a of connector bracket 334. Each of the through holes 342 and 344 are generally rectangular in plan and are of a size and shape to closely receive the square shank portion of threaded connector bolts which, in a manner presently to be described, are used to interconnect a second connector bracket 350 with bracket 334.

Second connector bracket 350, which functions to adjustably support rail R-6, is adjustably interconnected with first connector bracket 334 in a manner now to be described. Like bracket 334, leg 350b of connector bracket 350 is provided with first and second sets of through holes 352 and 354. Holes 352 are disposed along a third line 356 that extends angularly with respect to first leg 350a of connector bracket 350 and also angularly with respect to line 346. Similarly, through holes 354 are disposed along a fourth line 358 that extends angularly with respect to first leg 350a of connector bracket 350 and also angularly with respect to line 348. Each of the through holes 352 and 354 are also generally rectangular in plan and are of a size and shape to closely receive the square shank portion of the threaded connector bolts.

Through holes 352 formed in bracket 354 are so constructed and arranged that a selected one of the through holes 352 can be moved into index with a selected one of the through holes 342 formed in bracket 334 by a sliding movement of bracket 350 relative to bracket 334. Similarly, through holes 354 formed in bracket 350 are constructed and arranged so that a selected one of the through holes 354 can be moved into index with a selected one of the through holes 344 formed in bracket 334 when bracket 350 is moved from a first position to a second position relative to bracket 334.

More particularly, bracket 350 can be slidably moved relative to bracket 334 in a first direction generally parallel with leg 334a of bracket 334 or, alternatively, can be slidably moved in a second direction generally perpendicular to leg 334a of bracket 334.

When second connector bracket 350 is correctly aligned with first connector bracket 334 and a selected one of the though holes 352 is indexably aligned with a selected one of the through holes 312, a first bolt, such as a bolt 361, can be introduced into the aligned through holes. Similarly, when the connector bracket 350 is correctly aligned with bracket 334 and a selected one of the through holes 354 is indexably aligned with a selected one of the through holes 344, a second bolt, such as a bolt 363, can be introduced into the aligned through holes. With the bolts 361 and 363 in position with the square shank portions thereof closely received within the aligned holes, nuts such as nut 368 can be used to securely interconnect connector bracket 350 with bracket 334 in the manner shown in the drawings. When the brackets are thusly connected, the square shaped shank portions of the bolts will be snugly received within the indexably aligned through holes in the two brackets and will efficiently prevent sliding movement between the brackets.

Also forming a part of the connector apparatus of this latest form of the invention shown in figures 16A and 16B are connector means for interconnecting the guide rail ER-6 of the elevator system to leg 350a of second connector bracket 350. As before, this connector means comprises a pair of spaced apart connector clips 370 that are connected to second leg 350a of connector bracket 350 by threaded bolts 372. Each connector clip 370 has a rail engagement leg 370a that is adapted to clampingly engage the legs of the guide rail ER-6 in the manner shown in figure 16B.

The connector apparatus of this latest form of the invention also includes third and fourth spaced-apart right angle brackets 446 and 448. Bracket 446 has a first generally planar, outwardly extending leg 449 that has an aperture 450 formed therein and a second perpendicularly extending second leg 452 that has an aperture 454 and 455 extending there through. Bracket 448 also has a first generally planar, outwardly extending leg 456 that has an aperture 458 formed therein and a second perpendicularly extending second leg 460 that has a slot 462 extending there through.

Disposed in engagement with faces 440c of the vertically extending beams 440 is the first leg 464a of an elongated, connector bracket that is generally designated in the drawings by the numeral 464. More particularly, leg 464a of bracket 464 has a first face 467 that engages the outer faces of

the columns 460 and a second face 469 that engages the inner faces of legs 452 and 460 of brackets 446 and 448. Interconnecting legs 449 and 456 of second and third angle brackets 446 and 448 is a tie bolt 470. Tie bolt 470 extends through apertures 450 and 458 formed in legs 449 and 456 and is secured in position by a locking nut 471.

As shown in figure 16B, the assemblage made up of angle brackets 446, 448 and 464 and tie bolt 470 are interconnected with assembly 442 by a pair of tie bolts 475 and 475. Tie bolt 475 extends through apertures 454 and 324 formed in brackets 464 and 334 respectively. Tie bolt 477 extends through slots 462 and 443 of angle brackets 448 and 316 respectively. Tie bolt 475 also extends through apertures 454 and 445 formed in legs 464a and 334a of brackets 446 and 334. Tie bolt 477 also extends through slots 462 and 443 formed in legs 460 and 330 of brackets 448 and 316 respectively. Because of the configuration of slots 462 and 443, assembly 442 is free to move longitudinally of columns 440 to accommodate for any misalignment of rail R-6. In this latest form of the invention, angle brackets 316, 318,448 and 449, along with tie bolts 475 and 477 comprise the beam interconnection means of the invention for interconnecting connector bracket 334 with beams 440.

Turning next to figures 17, 18 and 19, these drawings more fully illustrate the form of the connector apparatus of the invention shown in portion E of figure 1B. This apparatus, which is generally designated by the numeral 480, functions to interconnect rails R-4 and R-5 with a horizontally extending beam 482. The apparatus here comprises a bracket in the form of a generally "U"-shaped member 484 (figure 18) and first, second, third and fourth angle brackets 485, 486, 488 and 490 that are connected to the bight portion 492 thereof (figure 19). In addition to the generally planar bight portion 492, member 482 has first and second upstanding legs or side portions 494 and 496 that extend generally perpendicular to bight portion 492.

As best seen in figure 17, spaced-apart brackets 484 and 486 are connected by a tie bolt 500, while spaced-apart brackets 488 and 490 are connected by a tie bolt 502. Disposed closely adjacent to one side of beam 482 and interconnecting first and third brackets 485 and 488 with a pair of capture plates 506 (figure 19) are spaced-apart tie bolts 508 and 510 respectively. In similar fashion, tie bolts 512 and 514, that are also disposed closely adjacent the opposite side of beam 482, function to interconnect second and fourth angle brackets 486 and 490 with spaced-apart capture plates 506.

As shown in figure 17, the underside of U shaped member 484 and the upper sides capture plates 506 are held in secure engagement with beam 482 by the four tie bolts 508, 510, 512, and 514. As is also shown in figure 17, slots 517 formed in angle brackets 486 and 490 permit transverse movement of the U-shaped member 484 relative to beam 482. In this latest form of the invention, angle brackets 485, 486, 488 and 490, along with capture plates 506 and tie bolts 500, 502, 508, 510, 512 and 514 comprise the beam inter-connection means of the invention for interconnecting connector bracket 484 with beam 482.

Also forming a part of the connector apparatus of this latest form of the invention are connector means for interconnecting guide rails R-4 and R-5 of the elevator system to legs 494 and 496 of U shaped member 484. This connector means here comprises a pair of spaced apart connector clips 520 that are connected to first leg 494 of U shaped member 484 by bolts 521 and a pair of spaced apart connector clips 522 that are connected to the second leg 496 of U shaped member 484 by bolts 523. As best seen in figure 17, each of the connector clips has a rail engagement leg 526 that is adapted to clampingly engage the legs of the guide rails in the manner shown in figure 17.

Referring next to figures 20, 21 and 22 another form of the connector apparatus of the invention is there shown and generally designated by the numeral 530. This apparatus, which functions to interconnect rails R-6 and R-7 with a horizontally extending "I" beam 532, comprises an upper U-shaped member 533, a pair of generally U-shaped members 534 and 536 that are connected to U-shaped member 533 and four pair of jackbolts 530 that are interconnected with the bight portions 535 of the U-shaped members 534 and 536. As best seen in figure 20, U-shaped member 534 is disposed on one side of the I beam while U-shaped members 536 is disposed on the opposite side of the I beam.

As shown in figures 20 and 22, each of the legs of the U-shaped bracket 534 is provided with a pair of longitudinally spaced apertures 541 that receive a pair of tie bolts 544. Similarly, each of the legs of U-shaped brackets 536 is provided with a pair of longitudinally spaced apertures 543 that receive a pair of tie bolts 546. Tie bolts 544 extend through a pair of spaced apart apertures 547 provided in U-shaped member 533, through apertures 541 provided in the legs of U-shaped member 534 and through apertures 549. provided in a pair of capture plates 550 (figure 22). Similarly, tie bolts 546 extend through a pair of spaced apart apertures 553 provided in this U-shaped member 533, through apertures 543 provided in the legs of U-

shaped member 536 and through apertures 555 provided in capture plates 550 (figures 21 and 22). With the construction thus described and as illustrated in the drawings, tie bolts 544 and 546, which comprise the connector means of the invention, function to maintain U-shaped member 533 in engagement with the top surface of the "I" beam, function to maintain capture plates 550 in engagement with the bottom surface of the I beam and function to maintain U-shaped members 534 and 536 at locations intermediate U-shaped member 533 and capture plates 550.

Jackbolts 530 are threadably received within adjustment nuts 530a that are connected to each of the jackbolts. Adjustment nuts 530a bear upon the outer surfaces of the bight portions of U-shaped members 534 and 536 so that, when the jackbolts are threaded inwardly and outwardly with respect to nuts 530a, the extremities by 530b of the jackbolts can be moved into and out of pressural engagement with the central web of the "I" beam, thereby permitting adjustment of the assemblage relative to rails R-6 and R-7 as indicated by the arrows 557in figure 20. In this latest form of the invention, U shaped members 534 and 536, along with jackbolts 530 and tie bolts 544 and 546 comprise the beam interconnection means of the invention for interconnecting connector bracket 533 with I beam 532.

Also forming a part of the connector apparatus of this latest form of the invention are connector means for interconnecting guide rails R-6 and R-7 of the elevator system to legs 533a of U shaped member 533. This connector means here comprises a pair of spaced apart connector clips 560 that are connected to each of the legs 533a of U shaped member 533 by bolts 562. As best seen in figure 22, each of the connector clips has a rail engagement leg 560a that is adapted to clampingly engage the legs of the guide rails in the manner shown in figure 22.

Considering now the embodiment of the invention shown in figures 23, 24 and 25, this embodiment is similar in many respects to that shown in figures 14, 15 and 16 and like numbers are used to identify like components. This latest embodiment comprises a connector apparatus for interconnecting the guide rails R-8 and R-9 of an elevator system with a horizontally extending beam 570 that is generally rectangular in cross section. As best seen in figure 25, this connector apparatus comprises two identical connector assemblies 572 and 572a that are interconnected by a pair of tie bolts 573 (figure 25).

As shown in figure 25, each of the connector assemblies 572 and 572a of this latest form of the invention comprises a first connector bracket 574 and a second connector bracket 386 that is adjustably connected to first

bracket 574 and is substantially identical to connector bracket 386 of figure 16. Second leg 574b of each bracket 574, which leg extends generally perpendicularly to leg 574a and accepts tie bolts 573, is provided with first and second sets of through holes 576 and 578, the purpose of which will presently be described. Holes 576 are disposed along the line 580 that extends angularly with respect to first leg 574a of connector bracket 574. Similarly, through holes 578 are disposed along a line 580 that extends angularly with respect to first leg 574a of connector bracket 574. Each of the through holes 576 and 578 are generally rectangular in plan and are of a size and shape to closely receive the square shank portion of threaded connector bolts which, in a manner presently to be described, are used to interconnect a second connector bracket 386 with bracket 574.

Second connector brackets 386, which function to adjustably support rails R-8 and R-9, are adjustably interconnected with first connector brackets 574 in a manner now to be described. As before, leg 386a of each connector bracket 386 is provided with first and second sets of through holes 402 and 404. Holes 402 are disposed along the line 406 that extends angularly with respect to second leg 386b of connector bracket 386 and also angularly with respect to line 580. Similarly, through holes 404 are disposed along a line 408 that extends angularly with respect to leg 386b of connector bracket 386

and also angularly with respect to line 580. Each of the through holes 402 and 404 of brackets 382 and 382a are also generally rectangular in plan and are of a size and shape to closely receive the square shank portion of the threaded connector bolts.

Through holes 402 formed in brackets 386 are so constructed and arranged that a selected one of the through holes 402 can be moved into index with a selected one of the through holes 576 formed in brackets 574 by a sliding movement of the brackets 386 relative to the brackets 574. Similarly, through holes 404 formed in brackets 386 are constructed and arranged so that a selected one of the through holes 404 can be moved into index with a selected one of the through holes 578 formed in brackets 574 when brackets 386 are moved from a first position to a second position relative to brackets 574. More particularly, brackets 386 can be slidably moved relative to brackets 574 in a first direction generally parallel with legs 574a of brackets 574 or, alternatively, can be slidably moved in a second direction generally perpendicular to legs 574a of brackets 574. In this latest form of the invention, capture plates 585, along with tie bolts 587 and 573 comprise the beam interconnection means of the invention for interconnecting connector brackets 574 with beam 570.

Also forming a part of the connector apparatus of this latest form of the invention are connector means for interconnecting guide rails R-8 and R-9 of the elevator system to legs 386b of brackets 386. This connector means here comprises a pair of spaced apart connector clips 370 that are connected to each of the legs 386b by bolts 372. As best seen in figure 25, each of the connector clips has rail engagement legs 370a that are adapted to clampingly engage the legs of the guide rails in the manner shown in figure 25.

As best seen in figure 24, brackets 574 are connected to a pair of capture plates 585 that extend beneath beam 570 by four spaced apart tie bolts 587 that are disposed closely adjacent to the sides of beam 570. As indicated in figure 24, the undersides of brackets 574 and the upper sides of capture plates 585 are held in secure engagement with beam 482 by the four tie bolts. As previously mentioned, assemblages 572 and 572a are connected together in the manner best seen in figures 23 and 25 by tie bolts 573.

It is to be understood that when the apparatus of this latest form of the invention is appropriately installed within the elevator hoistway, the various degrees of adjustment available to the installer permit the installer to precisely locate the guide rails R-8 and R-9 in an optimum position relative to the involved elevator cars.

Considering now the embodiment of the invention shown in figures 26 and 27, this embodiment is similar in many respects to that shown in figures 8 and 19 and like numbers are used to identify like components. This latest embodiment comprises a connector apparatus for interconnecting the guide rail R-10 of an elevator system with a wall W-5 of the building structure that houses the elevator system. As best seen in figure 27, the connector assembly 590 of this latest form of the invention comprises a first connector bracket 160 that is substantially identical to bracket 160 of figure 9 and includes a first generally planar first leg 162 that is adjustably connected to the supporting structure W-5 in the manner described in connection with the embodiment of figure 9.

Second leg 164 of bracket 160 is provided with a first set of through holes 186 and a spaced apart second set of first through holes 190. Adjustably interconnected with first connector bracket 160 is a second connector bracket 594. Second bracket 194 has a first leg 596 and a second leg 598 that extends generally perpendicular to first leg 596. Second bracket 594 is also provided with a first set of through holes 600 that are disposed along a first line 601 that extends at an angle with respect to first leg 596. Similarly, leg 598 is provided with another set of through holes 602 that are disposed along a line 604 that extends at an angle with respect to first leg 596. As in

the embodiment of figure 9, through holes 600 formed in bracket 594 are so constructed and arranged that a selected one of the through holes 600 can be moved into index with a selected one of the through holes 186 formed in bracket 160 by a sliding movement of bracket 594 relative to bracket 160. Similarly, through holes 602 formed in bracket 594 are constructed and arranged so that a selected one of the through holes 602 can be moved into index with a selected one of the through holes 190 formed in bracket 160 when bracket 594 is slidably moved from a first position to a second position relative to bracket 160. More particularly, bracket 594 can be slidably moved relative to bracket 160 in a first direction generally parallel with leg 162 of bracket 160 or, alternatively, can be slidably moved in a second direction generally perpendicular to leg 162 of bracket 160.

When second connector bracket 594 is correctly aligned with first connector bracket 160 and when the selected though holes in the brackets are indexably aligned, the brackets can be interconnected using bolts 217 and 219 in the manner described in connection with the embodiment of figure 9.

As in the earlier described embodiment, the connector apparatus of this latest form of the invention includes connector means for connecting the guide rail R-10 of the elevator system to first leg 596 of second bracket 594

in the manner illustrated in figures 26 and 27. In this latest form of the invention, the connector means is somewhat different from that shown in figures 8 and 9, but again comprises first and second spaced-apart connector clips 228 that are adjustably connected to first leg of connector bracket 594 by threaded bolts 229. As before, each connector clip 228 has a rail engagement leg 228a that is adapted to clampingly engage the legs of the guide rail R-10.

Bolts 229 extend through slots 607 provided in leg 596 of bracket 594 and also extend through apertures 611 provided in a pair of angle brackets 610 that are connected to bracket 594 by the bolts 229 and nuts 229a in the manner best seen in figure 27. Brackets 610 include an outwardly extending leg 614 that is provided with an aperture 615 that accept threaded jackbolts 618. Bracket 594 has a central upstanding wall 620 that is engaged by the ends 618a of each of the jackbolts 618. With this construction, it is apparent that by threading the jackbolts inwardly and outwardly relative to wall 620, the position of angle brackets 610 along with clips 228 can be moved to further accommodate any misalignment of rail R-10.

Turning finally to figures 28 and 29, the embodiment there shown is similar in many respects to that shown in figures 2, 3 and 4 and like numbers are used to identify like components. The basic difference between this latest

embodiment and that shown in figures 2, 3 and 4 resides in the provision of a slightly different rail connector means for supporting rail R-11. This latest embodiment comprises a connector assembly 15 that function to interconnect guide rail R-11 with two pair of vertically extending beams generally designated in the drawings by the numerals 625 and 625a.

As shown in figure 29, connector assembly 15 of this form of the invention, like that shown in figure 2, comprises first, second, third, and fourth spaced-apart right angle brackets 16, 18, 20, and 22 respectively that function to interconnect a bracket 628 with columns 625 and 625a in the manner described in connection with the connection of bracket 66 to the columns in the embodiment of figure 2. Bracket 628 is identical to bracket 66 save that bracket 628 does not have end walls 76, but does have a central, outwardly extending wall 630 that is connected to leg 628a of bracket 628.The purpose of this central wall will presently be described.

As best seen in figure 29, connector bracket 42 of this latest embodiment has a second leg 42b that extends generally perpendicularly to leg 42a. Formed within second leg 42 of connector bracket 42 are first and second sets of through holes 59 and 61 that are adapted to index with first and second sets of through holes 633 and 635 formed in leg 628b of bracket 628. More particularly, as in the embodiment of figure 2, through holes 633

formed in bracket 628 are so constructed and arranged that a selected one of the through holes 633 can be moved into index with a selected one of the through holes 59 formed in bracket 42 by a sliding movement of bracket 42 relative to bracket 628. Similarly, through holes 635 formed in bracket 628 are constructed and arranged so that a selected one of the through holes 635 can be moved into index with a selected one of the through holes 61 formed in bracket 42 when bracket 628 is slidably moved from a first position to a second position relative to bracket 42. More particularly, bracket 628 can be slidably moved relative to bracket 42 in a first direction generally parallel with leg 42a of bracket 42 or, alternatively, can be slidably moved in a second direction generally perpendicular to leg 42a of bracket 42. When second connector bracket 628 is correctly aligned with first connector bracket 42 and when the selected though holes in the brackets are indexably aligned, the brackets can be interconnected using bolts 72 and 74 in the manner described in connection with the embodiment of figure 2. In this latest form of the invention, angle brackets 16, 18, 20 and 22, along with spanner plate 32, comprise the interconnection means of the invention for interconnecting first connector bracket 42 with beams 625 and 625a.

Also forming a part of the connector apparatus of the form of the invention shown in figures 30 and 31 are connector means for interconnecting

guide rail R-11 to leg 628a of second connector bracket 628. In this latest form of the invention, this connector means comprises a pair of spaced apart connector clips 638 that are adjustably connected to leg 628a of connector bracket 628 by threaded bolts 75. Each connector clip 638 has a rail engagement leg 638a that is adapted to clampingly engage the legs of the guide rail R-11.

Bolts 75 extend through slots 639 provided in leg 628a of bracket 628 and also extend through apertures 641 provided in a pair of angle brackets 644 that are connected to bracket 628 by the bolts 75 and nuts 80 in the manner best seen in figure 29. Brackets 644 include an outwardly extending leg 644a, each if which is provided with an aperture 645 that accepts a threaded jackbolt 648. The ends 648a of each of the jackbolts engage earlier identified central wall 630 so that by threading the jackbolts inwardly and outwardly relative to wall 630, the position of angle brackets 610 along with clips 228 can be adjusted to further accommodate any misalignment of rail R-11.

As in the earlier described embodiments, when the apparatus of this latest form of the invention is appropriately installed within the elevator hoist the various degrees of adjustment available to the installer permit the

installer to precisely locate guide rail R-11 in an optimum position relative to the involved elevator cars.

Considering now the embodiment of the invention shown in figures 30, 31, 32 and 33, this embodiment is similar in some respects to that shown in figures 17, 18 and 19. This latest embodiment comprises a connector apparatus for interconnecting the guide rails R-12 and R-13 of an elevator system with a horizontally extending beam 660 that is generally rectangular in cross section. As best seen in figure 32, this connector apparatus comprises a generally "U" shaped member 662 (figure 33) and four angle brackets 664, 666, 668 and 670 that are connected to the bight portion 662a thereof (figure 32). In addition to bight portion 662a, member 662 has two upstanding side portions 662b and 662c.

As best seen in figure 32, brackets 664 and 666 are connected by a tie bolt 672, while brackets 668 and 670 are connected by a tie bolt 674. Disposed closely adjacent to one side of beam 660 and interconnecting first and third brackets 664 and 668 with a pair of capture plates 678 (figure 32) are spaced-apart tie bolts 680 and 682 respectively. In similar fashion, tie bolts 684 and 686, that are also disposed closely adjacent the opposite side of beam 660, function to interconnect second and fourth angle brackets 666 and 670 with capture plates 678.

As shown in figure 30, the underside of U-shaped member 662 and the upper sides capture plates 678 are held in secure engagement with beam 660 by the four tie bolts 680, 682, 684 and 686. As is also shown in figure 32, slots 689 formed in angle brackets 666 and 668 permit transverse movement of the U-shaped member 662 relative to beam 660. In this latest form of the invention, angle brackets 664, 666, 668 and 670, 486, along with capture plates 678 and tie bolts 680, 682, 684, and 686, comprise the beam interconnection means of the invention for interconnecting connector bracket 662 with beam 660.

Also forming a part of the connector apparatus of this latest form of the invention are connector means for interconnecting guide rails R-12 and R-13 of the elevator system to legs 662b and 662c of U-shaped member 662. This connector means here comprises a pair of spaced apart connector slips 692 and 694 that are connected to first leg 662b of U-shaped member 662 by bolts 695 and a pair of spaced-apart connector clips 696 and 698 that are connected to the second leg 662c of U-shaped member 662 by bolts 699. As best seen in figure 32, each of the connector clips has a rail engagement leg 700 that is adapted to clampingly engage the legs of the guide rails in the manner shown in figure 32.

As best seen in figure 33, sidewall 662b of U-shaped member 662 is provided with spaced-apart, elongated-bolt-receiving apertures that are adapted to receive connector bolt 95. Similarly, sidewall 662c of the U-shaped member is provided with elongated-bolt-receiving apertures 704 for receiving connector bolts 669. Connector bolts 695 also extend through bores provided in one leg of a pair of angle brackets 706 and 7087 and along with nuts 709 function to interconnect brackets 706 and 708 with sidewall 662b. In like manner connector bolts 699 also extend through bores provided in one leg of a pair of angle brackets 710 and 712 and along with nuts 711 function to interconnect brackets 710 and 712 with sidewall 662c of U-shaped member 662.

A novel feature of this latest form of the invention comprises adjustment means for adjusting the position of the connector chips relative to member 662. This adjustment means here comprises a jackbolt supporting bracket 716 that is connected to sidewall 262b of U-shaped member 662 by a bolt 714 is a jackbolt supporting bracket 716. Similarly, a jackbolt supporting bracket 718 is connected to sidewall 662c by a bolt 720. Leg 716a of bracket 716 is provided with a threaded bore 716c that is adapted to receive the shank of a threaded jackbolt 722. Angle brackets 706 and 708 are also aperture to receive the shank of jackbolt 722 in the manner shown in

figure 32. As shown in figure 32, jackbolt 722 is threadably received within a series of adjustment nuts 724 that bear upon the surfaces of the outwardly extending legs of brackets 716, 706 and 708 so that, when the jackbolt is threaded inwardly and outwardly with respect to nuts 724, clips 692 and 694 can be adjusted longitudinally of side 662b to adjustably position rail R-12. It is apparent that by loosening adjustment nuts 724, bolts 695 along with clips 692 and 694 can be moved toward and away from guide rail R-12 and can be securely locked in position by retightening the locking nuts.

As is shown in figure 32, leg 718a of bracket 718 is provided with a threaded bore 718c that is adapted to receive the shank of a threaded jackbolt 726. Angle brackets 710 and 712 are also aperture to receive the shank of jackbolt 726 in the manner there illustrated. Jackbolt 726 is threadably received within a series of adjustment nuts 728 that bear upon the surfaces of the outwardly extending legs of brackets 718, 710 and 712 so that, when the jackbolt is threaded inwardly and outwardly with respect to nuts 728, clips 696 and 698 can be adjusted longitudinally of side 662c to adjustably position rail R-13. It is apparent that by loosening adjustment nuts 728, bolts 699 along with clips 696 and 698 can be moved toward and away from guide rail R-13 and can be securely locked in position by retightening the locking nuts.

It is to be understood that when the apparatus of the invention is installed within the hoistway in the manner shown in figure 1A, the various degrees of adjustment available to the installer permits the installer to precisely locate the guide rails R-12 and R-13 in an optimum position to permit smooth and efficient operation of the elevator system.

Turning next to figures 34, 35, 36 and 37, still another embodiment of the invention is there shown. This embodiment, which is similar in some respects to that shown in figures 28 and 29, comprises a connector apparatus for interconnecting a guide rail R-14 of an elevator system with a horizontally extending beam 740 that is generally rectangular in cross section. As best seen in figures 35 and 36, this connector apparatus comprises a generally rectangularly shaped member 742 (figure 36) and four angle brackets 744, 746, 748 and 750 that are connected thereto.

As shown in figure 34, brackets 744 and 746 are connected by a tie bolt 752, while brackets 748 and 750 are connected by a tie bolt 754. Disposed closely adjacent to one side of beam 740 and interconnecting first and third brackets 744 and 748 with a pair of angle brackets 756 (figure 36) are spaced-apart tie bolts 758 and 760 respectively. In similar fashion, tie bolts 762 and 764, that are also disposed closely adjacent the opposite side of beam 740, function to interconnect second and fourth angle brackets 746 and

750 with angle brackets 766. Brackets 756 and 766 are connected by a tie bolt 770, while brackets 748 and 750 are connected by a tie bolt 754.

As illustrated in figure 34, the underside of member 662 and the upper sides of angle brackets 756 and 766 are held in secure engagement with beam 740 by the four tie bolts 758, 760, 762 and 764. Slots formed in the lower angle brackets permit transverse movement of member 742 relative to beam 740. In this latest form of the invention, the upper and lower angle brackets, along with tie bolts 758, 760, 762 and 764, comprise the beam interconnection means of the invention for interconnecting connector member 742 with beam 740.

A connector bracket 774 of the configuration shown in figure 37 is adjustably connected to connector member 742 by a pair of connector bolts 776 and 778. As best seen in figure 36, connector bracket 774 is provided with first and second sets of through holes 776 and 778, the purpose of which will presently be described. Holes 776 are disposed along a line 780 that extends angularly with respect to a connector leg 774a formed on connector bracket 774. Similarly, through holes 778 are disposed along a line 782 that extends angularly with respect to connector leg 774a of connector bracket 774. Each of the through holes 776 and 778 are generally rectangular in plan and are of a size and shape to closely receive the square shank

portion of the threaded connector bolts 776 and 778 which, are used to interconnect connector bracket 774 with member 742.

Connector bracket 774, which function to adjustably support rail R-14 is adjustably interconnected with member 742 in a manner now to be described. As shown in figure 36 member 742 is provided with first and second sets of through holes 784 and 786. Holes 784 are disposed along a line 788 that extends angularly with respect to the plane of leg 774a of connector bracket 774 and also angularly with respect to line 780. Similarly, through holes 786 are disposed along a line 790 that extends angularly with respect to the plane of leg 774a of connector bracket 774 and also angularly with respect to line 782. Each of the through holes 784 and 786 of member 742 are also generally rectangular in plan and are of a size and shape to closely receive the square shank portion of the threaded connector bolts 776 and 778.

In the manner shown in figure 36, through holes 776 are adapted to index with through holes 784 and, through holes 778 are adapted to index with through holes 786. More particularly, as in the earlier described embodiments 2, through holes 776 formed in bracket 774 are so constructed and arranged that a selected one of the through holes 776 can be moved into index with a selected one of the through holes 784 formed in member 742 by a sliding movement of bracket 774 relative to member 742. Similarly,

through holes 778 formed in bracket 774 are constructed and arranged so that a selected one of the through holes 778 can be moved into index with a selected one of the through holes 786 formed in member 742 when bracket 774 is slidably moved from a first position to a second position relative to member 742. More particularly, bracket 774 can be slidably moved relative to member 742 in a first direction generally parallel with leg 774a of bracket 774 or, alternatively, can be slidably moved in a second direction generally perpendicular to leg 774a of bracket 774. When connector bracket 774 is correctly aligned with member 742 and when the selected though holes in the components are indexably aligned, the components can be interconnected using bolts 776 and 778 in the manner previously described herein

Also forming a part of the connector apparatus of the form of the invention shown in figures 34, 35, 36 and 37 are connector means for interconnecting guide rail R-14 to leg 774a of connector bracket 774. In this latest form of the invention, this connector means comprises a pair of spaced apart connector clips 794 that are adjustably connected to leg 774a of connector bracket 774 by threaded bolts 796. Each connector clip 794 has a rail engagement leg 794a that is adapted to clampingly engage the legs of the guide rail R-14.

Bolts 796 extend through slots 797 provided in leg 774a of bracket 774 and also extend through apertures 799 provided in a pair of angle brackets 800 that are connected to bracket 774 by the bolts 796 and nuts 802 in the manner best seen in figure 36. Brackets 800 include an outwardly extending leg 800a, each if which is provided with an aperture 805 that accepts a threaded jackbolt 806.

Also connected to leg 774a of bracket 774 by a bolt 808 is a jackbolt supporting bracket 810. Leg 810a of bracket 810 is provided with a bore 810b that is adapted to receive the shank of a threaded jackbolt 806. As shown in figure 36, jackbolt 806 is threadably received within a series of adjustment nuts 812 that bear upon the surfaces of the outwardly extending legs of brackets 805 and 810, so that, when the jackbolt is threaded inwardly and outwardly with respect to nuts 812, clips 794 can be adjusted longitudinally of leg 774a to adjustably position rail R-14. It is apparent that by loosening adjustment nuts 812, bolts 796 along with clips 794 can be moved toward and away from guide rail R-14 and can be securely locked in position by retightening the locking nuts.

As in the earlier described embodiments, when the apparatus of this latest form of the invention is appropriately installed within the elevator hoist the various degrees of adjustment available to the installer permit the

installer to precisely locate guide rail R-14 in an optimum position relative to the involved elevator cars.

Turning next to figures 38, 39, 40 and 41 another form of connector apparatus for interconnecting the guide rails of an elevator system with a pair of vertically extending columns is there shown. Referring particularly to figures 39 and 41, the connector assembly of this form of the invention can be seen to comprise a main support structure 820 (figure 41) to which first, second, third, and fourth spaced-apart right angle brackets 822, 824, 826 and 828 are connected (figure 39). As best seen in figure 41, main support structure 820 comprises a base 830 having a pair of spaced-apart elongated sidewalls 832 and 834 respectively and a central, generally planer portion 836. Each of the sidewalls has a circular aperture 838 and elongated aperture 840. Also comprising of main support structure 820 is a generally U- shaped connector member 844 that includes a bight portion 820a and a pair of upstanding leg portions 820b and 820c respectively. Connected to each of the leg portions proximate their center is an inwardly extending apertured connector wall 846 the purpose of which will presently be described. Angle bracket 822 has a first generally planar, outwardly extending leg 822a that has an aperture 823 formed therein and a second perpendicularly extending second leg 822b that has an aperture 825 extending there

through. Similarly, angle bracket 824 has a first generally planar, outwardly extending leg 824a that has an aperture 825 formed therein and a second perpendicularly extending second leg 824b that has an aperture 827 extending there through. In like manner, angle bracket 826 has a first generally planar, outwardly extending leg 826a that has an aperture 829 formed therein and a second perpendicularly extending second leg 826b that has an aperture 831 extending there through. Similarly, angle bracket 828 has a first generally planar, outwardly extending leg 828a that has an aperture 833 formed therein and a second perpendicularly extending second leg 828b that has an aperture 835 extending there through.

A tie bolt 850 extends through apertures 825, 840 and 827 and functions to interconnect angle brackets 822 and 824 and to secure them in engagement with vertical column 854. Similarly, a tie bolt 852 extends through apertures 831, 838 and 835 and functions to interconnect angle brackets 826 and 828 and to secure them in engagement with vertical column 856 (figure 39).

As is also illustrated in figure 39, an elongated, threaded tie bolt 858 extends through apertures 823 and 829 and functions to interconnect angle brackets 822 and 826. Similarly, an elongated tie bolt 860 extends through apertures 825 and 833 and functions to interconnect angle brackets 824 and

828. Tie bolts also function to bring tie bolts 850 and 852 into engagement with the vertical columns in the manner shown in figure 39. With the construction thus described main support structure 820 can be securely interconnected with vertical columns 854 and 856 at any desired location along the columns.

Formed within bight portion 820a of connector 820 are first and second sets of through holes 864 and 866, the purpose of which will presently be described. Holes 864 are disposed along the line 868 that extends at an acute angle with respect to legs 820b and 820c of connector 820. Similarly, through holes 866 are disposed along a line 870 that extends at an acute angle with respect to legs 820b and 820c of connector 820. Each of the through holes 864 and 866 are generally rectangular in plan and are of a size and shape to closely receive the square shank portion of threaded connector bolts which, in a manner presently to be described, are used to interconnect member 820 with central, generally planer portion 836 of base 830 of main support structure 820.

Like bight portion 820a, portion 836 is provided with first and second sets of through holes 874 and 876 (figure 39). Holes 874 are disposed along the line 880 that extends at an acute angle with respect to first leg 66a of connector bracket 66 and also angularly with respect to sides 820b and 820c.

Similarly, through holes 876 are disposed along a line 882 that extends angularly with respect to sides 820b and 820c. Each of the through holes 874 and 876 are also generally rectangular in plan and are of a size and shape to closely receive the square shank portion of threaded connector bolts 888.

Through holes 864 formed in bracket 820 are so constructed and arranged that a selected one of the through holes can be moved into index with a selected one of the through holes 874 formed in base portion 836 by a sliding movement of bracket 820 relative to base portion 836. Similarly, through holes 866 formed in bracket 820 are constructed and arranged so that a selected one of the through holes can be moved into index with a selected one of the through holes 876 formed in base portion 836 when bracket 820 is moved from a first position to a second position relative to the base portion. More particularly, bracket 820 can be slidably moved relative to the base portion in a first transverse direction generally parallel with sides 820b and 820c of bracket 820 or, alternatively, can be slidably moved in a second direction generally perpendicular to sides 820b and 820c of bracket 820.

When connector bracket 820 is correctly aligned with base portion 836 and a selected one of the though holes 864 is indexably aligned with a selected one of the through holes 874, a selected connector bolt 888 can be

introduced into the aligned through holes. Similarly, when the connector bracket 820 is correctly aligned with base portion 836 and a selected one of the though holes 866 is indexably aligned with a selected one of the through holes 876, a selected connector bolt 888 can be introduced into the aligned through holes. With the bolts in position with the square shank portions thereof closely received within the aligned holes, nuts such as nut 888a can be used to securely interconnect connector bracket 820 with base portion 836 in the manner shown in figure 38. When the components are thusly connected, the square shaped shank portions of the bolts will be snugly received within the indexably aligned through holes and will efficiently prevent sliding movement between the components even under severe loading conditions.

Also forming a part of the connector apparatus of the form of the invention shown in figures 38 and 39 are connector means for adjustably interconnecting the guide rails R-15 and R-16 of the system to the side portions of connector bracket 820. In the present form of the invention, this connector means comprises a pair of spaced apart connector clips 890 that are adjustably connected to side 820b of connector bracket 820 by threaded bolts 891. Each connector clip has a rail engagement leg 890a that is adapted to clampingly engage the legs of the guide rail R-15.

Bolts 891 extend through slots 894 provided in leg 820b of bracket 820 (figure 41) and also extend through apertures 895 provided in a pair of angle brackets 896 that are connected to side 820b by the bolts 891 and nuts 891a in the manner best seen in figure 39. Brackets 896 include an outwardly extending leg 896a that is provided with an aperture 897 that accepts a threaded jackbolt 900.

Each of the previously identified walls 846 that extend inwardly from sides 820b and 820c are provided with a bore 846a that is adapted to receive the shank of a threaded jackbolt 900. As shown in figure 39, jackbolt 900 is threadably received within a series of adjustment nuts 902 that bear upon the surfaces of the outwardly extending legs of brackets 895 and also on the opposing surfaces of walls 846 so that, when the jackbolt is threaded inwardly and outwardly with respect to nuts 902, clips 890 can be adjusted longitudinally of side 820b to adjustably position rail R-15. It is apparent that by loosening adjustment nuts 902, bolts 891 along with clips 890 can be moved toward and away from guide rail R-15 and can be securely locked in position by retightening the locking nuts.

In the present form of the invention, the connector means also comprises a pair of spaced apart connector clips 906 that are adjustably connected to side 820c of connector bracket 820 by threaded bolts 907. Each

connector clip has a rail engagement leg 906a that is adapted to clampingly engage the legs of the guide rail R-16.

Bolts 907 extend through slots 909 provided in leg 820c of bracket 820 (figure 41) and also extend through apertures 911 provided in a pair of angle brackets 912 that are connected to side 820c by the bolts 907 and nuts 907a in the manner best seen in figure 39. Brackets 912 include an outwardly extending leg 912a that is provided with an aperture 914 that accepts a threaded jackbolt 916. Jackbolt 916 also extends through bore 846a one of the previously identified walls 846 that extends inwardly from side 820c of bracket 820. As shown in figure 39, jackbolt 916 is threadably received within a series of adjustment nuts 918 that bear upon the surfaces of the outwardly extending legs of brackets 912 and also on the opposing surfaces of wall 846 so that, when the jackbolt is threaded inwardly and outwardly with respect to nuts 918, clips 906 can be adjusted longitudinally of side 820c to adjustably position rail R-16. It is apparent that by loosening adjustment nuts 918, bolts 907 along with clips 906 can be moved toward and away from guide rail R-16 and can be securely locked in position by retightening the locking nuts.

As in the earlier described embodiments, when the apparatus of this latest form of the invention is appropriately installed within the elevator

hoistway the various degrees of adjustment available to the installer permit the installer to precisely locate guide rails R-15 and R-16 in an optimum position relative to the involved elevator cars.

Referring next to figures 42 through 45, an alternate form of a connector apparatus of the invention for use interconnecting a guide rail R-17 with a supporting structure such as a selected wall of the structure that houses the elevator hoistways is there shown. As best seen in figure 43, the connector assembly 960 of this latest form of the invention comprises a first connector bracket 964 having a first generally planar first leg 966 that is connected to the supporting structure "SS". Leg 966 extends generally perpendicularly from a second leg 967 that has a generally planar surface 967a. Leg 966 is provided with spaced-apart apertures 968 and 970. Received within apertures 968 and 970 are the threaded shank portions 972a of a pair of anchor bolts 972, the body portions 970b of which are embedded within the concrete of the supporting wall "SS". The threaded shank portions 972a of bolts 972 extend through apertures 968 and 970 and are interconnected with leg 966 of bracket 964 by locking nuts 974.

Leg 967 of bracket 964 is provided with a plurality of first through holes 976 that are disposed along a first line 978 that extends at an acute angle with respect to first leg 966. Similarly, leg 967 is provided with a second

set of through holes 980 that are disposed along a second line 982 that extends at an acute angle with respect to first leg 966.

Adjustably interconnected with first connector bracket 964 is a second connector bracket 984. Second bracket 984 has a first leg 984a and a second leg 984b that extends generally perpendicular to first leg 984a. As best seen in figures 43 and 45, second bracket 984 is also provided with a plurality of through holes 986 that are disposed along a first line 987 that extends at an acute angle with respect to first leg 984a. Similarly, leg 986 is provided with another set of through holes 988 that are disposed along a line 989 that extends at an acute angle with respect to first leg 984a. Through holes 986 formed in bracket 984 are so constructed and arranged that a selected one of the through holes 986 can be moved into index with a selected one of the through holes 976 formed in bracket 964 by a sliding movement of bracket 984 relative to bracket 964. Similarly, through holes 988 formed in bracket 984 are constructed and arranged so that a selected one of the through holes 988 can be moved into index with a selected one of the through holes 980 formed in bracket 964 when bracket 984 is slidably moved from a first position to a second position relative to bracket 964. More particularly, bracket 984 can be slidably moved relative to bracket 964 in a first direction generally parallel with leg 966 of bracket 964 or, alternatively, can be slidably

moved in a second direction generally perpendicular to leg 966 of bracket 964.

When second connector bracket 984 is correctly aligned with first connector bracket 964 and a selected one of the though holes 986 is indexably aligned with a selected one of the through holes 978, a first bolt, such as a bolt 990, can be introduced into the aligned through holes. Similarly, when the connector bracket 984 is correctly aligned with bracket 964 and a selected one of the through holes 988 is indexably aligned with a selected one of the through holes 980, a second bolt, such as a bolt 991, can be introduced into the aligned through holes. With the bolts 990 and 991 in position with the square shank portions thereof (figure 43) closely received within the aligned holes, nuts can be used to securely interconnect connector bracket 984 with bracket 964 in the manner shown in figures 43 and 44. When the brackets are thusly connected, the square shaped shank portions of the bolts will be snugly received within the indexably aligned through holes in the two brackets and will efficiently prevent sliding movement between the brackets.

The connector apparatus of this latest form of the invention further includes connector means for connecting guide rail R-17 to first leg 984a of second bracket 984 in the manner illustrated in figures 43, 44 and 45. In this

latest form of the invention, the connector means comprises first and second spaced-apart connector clips 994 that are of a similar construction to the earlier identified connector clips. Connector clips 994 are adjustably connected to first leg of connector bracket 984 by threaded bolts 994a. Each connector clip 994 has a rail engagement leg 944b that is adapted to clampingly engage the legs of the guide rail R-17.

Bolts 994a extend through slots 995 provided in leg 984a of bracket 984 (figure 45) and also extend through apertures provided in a pair of angle brackets 996 that are connected to side 984a by the bolts 994a and mating nuts in the manner best seen in figure 43. Brackets 996 include an outwardly extending leg 996a that is provided with an aperture that accepts a threaded jackbolt 998. Jackbolt 998 also extends through a bore 1000a provided in an outwardly extending angle bracket 1000 that is connected to wall 984a of bracket 984. As shown in figure 43, jackbolt 998 is threadably received within a series of adjustment nuts 1002 that bear upon the surfaces of the outwardly extending legs of brackets 996a and 1000 so that, when the jackbolt is threaded inwardly and outwardly with respect to nuts 1002, clips 994 can be adjusted longitudinally of wall 984a to adjustably position rail R-17. It is apparent that by loosening adjustment nuts 1002, bolts 994a along

with clips 994 can be moved toward and away from guide rail R-17 and can be securely locked in position by retightening the locking nuts.

As in the earlier described embodiments, when the apparatus of this latest form of the invention is appropriately installed within the elevator hoistway the various degrees of adjustment available to the installer permit the installer to precisely locate guide rail R-17 in an optimum position within the hoistway.

Having now described the invention in detail in accordance with the requirements of the patent statutes, those skilled in this art will have no difficulty in making changes and modifications in the individual parts or their relative assembly in order to meet specific requirements or conditions. Such changes and modifications may be made without departing from the scope and spirit of the invention, as set forth in the following claims.